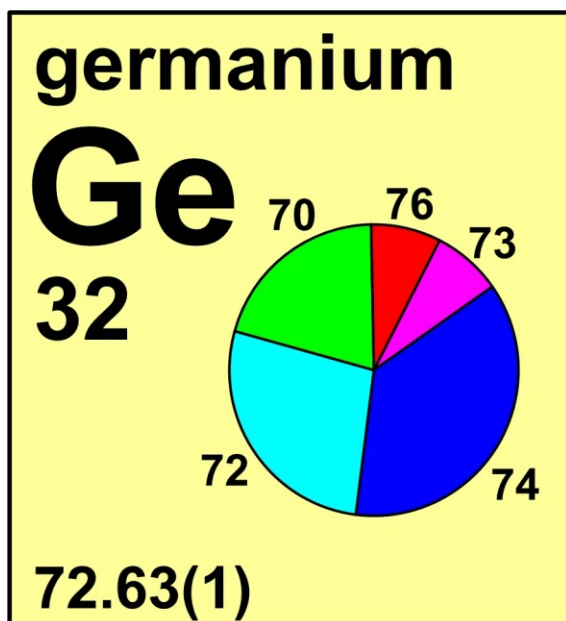


## germanium

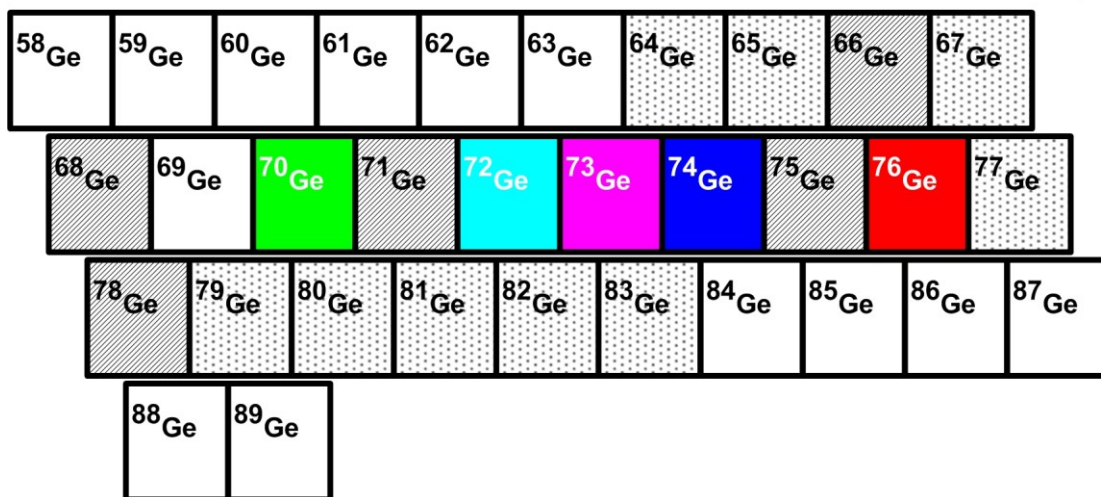


Stable isotope	Atomic mass*	Mole fraction
$^{70}\text{Ge}$	69.924 2474	0.203 70
$^{72}\text{Ge}$	71.922 0758	0.273 80
$^{73}\text{Ge}$	72.923 4589	0.077 59
$^{74}\text{Ge}$	73.921 1778	0.366 56
$^{76}\text{Ge}$	75.921 4026	0.078 35

\* Atomic mass given in unified atomic mass units, u.

### Half-life of radioactive isotope

Less than 1 second  
Between 1 second and 1 hour  
Greater than 1 hour



## Important applications of stable and/or radioactive isotopes

### Isotopes in physics

- $^{76}\text{Ge}$  Germanium can undergo a rare (and hence very long-lived) nuclear decay process known as double beta decay. The  $^{76}\text{Ge}$  nucleus can decay to  $^{76}\text{Se}$  and may produce two or no neutrinos in the process. A careful measurement of the half-life for this decay, which is on the order of  $10^{25}$  years, can be used to place an upper limit on the mass of the electron neutrino, a neutral and weakly interacting subatomic particle first postulated by Wolfgang Pauli in 1930.

## Isotopes in medicine

- 1)  $^{72}\text{Ge}$  and  $^{74}\text{Ge}$  are used to produce radioactive isotopes of  $^{72}\text{As}$  and  $^{74}\text{As}$ , respectively.  
The arsenic nuclei can attach to tumors and the decay of these isotopes is used to image the location of cancerous tumors in vivo.
- 2)  $^{70}\text{Ge}$ ,  $^{72}\text{Ge}$  and  $^{74}\text{Ge}$  have all been used to produce medical radioisotopes  $^{73}\text{Se}$ .